Low Light Short Wave Infrared Focal Plane Arrays

The official link for this solicitation is:
http://www.acq.osd.mil/osbp/sbir/solicitations/sbir20152/index.shtml

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Description:
This topic focuses on enabling next generation sensors and improving FPA performance beyond the current state-of-the-art to support future missile defense applications. This topic seeks low noise, high sensitivity FPA technologies that detect very low signal levels. Current FPA technologies for imaging in low-light conditions at SWIR wavelengths are limited by poor quantum efficiency and/or poor noise characteristics. Silicon-based technologies offer low noise devices; however, the quantum efficiencies of these devices is typically a few percent at SWIR wavelengths. Technologies based on other substrates (HgCdTe, InGaAs, etc.) have fairly high quantum efficiencies (greater than 50%) at SWIR wavelengths, but the noise characteristics of these devices are typically too large for very low light sensing conditions. Technologies based on avalanche photodiodes (APDs) are capable of imaging in low-light conditions; however, APD technologies have limitations: in the case of Geiger mode APDs, their response to input photon flux is non-linear and in the case of linear-mode APDs, their array sizes are small. This topic does not focus on particular substrate/readout integrated circuit combinations but solicits technical solutions for imaging objects under low light conditions at SWIR wavelengths. Goals for the topic are: 1) quantum efficiencies for silicon-based substrates that are greater than 60% (at 900nm), 35% (at 1000nm), and 20% (at 1100 nm) or quantum efficiencies for non-silicon-based substrates that are greater than 30% across the 900-1200 nm region 2) dark currents that are less than 100 electrons/pixel/second at 77K 3) readout noises less than 5 electrons 4) formats that are greater than 512 X 512 with extensibility to 1k X 1k 5) frame rates of 30Hz with integration times up to 30 milliseconds 6) programmable with capability of 2 X 2 binning of pixels 7) excess noise factor that is less than 2 for technologies that use gain 8) linear response to incident

flux The proposed technologies should also include designs that mitigate the effects of harsh radiation environments to prevent catastrophic system failure. PHASE I: Conduct modeling, simulations, and analysis (MS&A), and proof-of-principle experiments of the critical elements for the proposed FPA technology. This phase should validate the feasibility of the proposed technology. Phase I will conclude with a proof-of-concept design review of the detector technology to include a clear, concise technology development plan and schedule, predicted FPA performance metrics, a transition risk assessment, and associated requirements documentation. The contractor is strongly encouraged to collaborate and cultivate relationships with other system and/or sensor payload contractors to ensure the applicability of the FPA technology and to initiate work towards technology transition. No specific contact information will be provided by the topic authors. PHASE II: Using the resulting processes, designs, techniques, and architectures, developed in Phase I, fabricate a prototype or engineering demonstration unit of the FPA technology. Perform characterization testing of the FPA within the program constraints of cost and schedule. The characterization tests should show the performance achieved from the FPA technology. Environmental testing: vibration, thermal, and radiation testing (if applicable) is encouraged. Differences between the MS&A and the FPA performance data should be noted. During this phase, the contractor should continue to collaborate and cultivate relationships with other system and/or sensor payload contractors while considering the overall objective of commercialization of the detector technology in Phase III. PHASE III: The offeror will implement and verify in full scale, either solely, or in partnership with a suitable production foundry, that the Phase II demonstration technology is economically viable. Assist in transitioning the detector technology for missile defense applications to an appropriate contractor for engineering integration and testing. Commercialization: The contractor will pursue commercialization of the various technologies developed in Phase II for potential commercial uses in other government applications. In addition, there are potential applications for detector technologies in a wide range of diverse fields that include astronomy, commercial satellite imagery, optical and free-space communications, law enforcement, maritime and aviation sensors, spectroscopy, atmospheric measurements (in-situ and remote sensing), and terrain mapping.